

## CLAIMS:

1. An object collaboration apparatus, wherein objects comprise:
  - a message receiving portion for monitoring and inputting messages that have
  - 5 been sent over a network;
  - a message/action reaction relation storage portion for storing relations between messages and information on actions that are reactions to the messages; and
  - an action execution portion that executes actions in accordance with the message/action reaction relations; wherein
  - 10 if in the message/action reaction relation storage portion, messages associated with an action are expressed as a message pattern and are given as all messages belonging to the scope indicated by that message pattern, and if a message received by the message receiving portion belongs to the scope indicated by the message pattern, then the action is associated with that received message as a reaction.
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2. An object collaboration apparatus, wherein objects comprise:
  - a message receiving portion for monitoring and inputting messages that have
  - been sent over a network;
  - a message/action reaction relation storage portion for storing relations between
  - 20 messages and information on actions that are reactions to the messages; and
  - an action execution portion that executes actions in accordance with the message/action reaction relations; wherein
  - if a message received by the message receiving portion is expressed as a message pattern and is given as all messages belonging to the scope indicated by that
  - 25 message pattern,
  - then an action associated with the messages belonging to the scope indicated by that message pattern is associated as a reaction in the message/action reaction relation storage portion.
- 30 3. An object collaboration apparatus, wherein objects comprise:
  - a message receiving portion for monitoring and inputting messages that have
  - been sent over a network;

a message/action reaction relation storage portion for storing relations between messages and information on actions that are reactions to the messages;

an action execution portion that executes actions in accordance with the message/action reaction relations;

5        a message/action reaction relation update control portion for controlling an updating of reaction relations between messages and actions in accordance with the necessity to update the message/action reaction relations; and

10        a message/action reaction relation organizing portion for associating specified actions to specified messages with the message/action reaction relation update controlling portion; wherein

a new reaction relation between an action and a message is organized by intervening into an existing reaction relation between an action and a message.

4.        The object collaboration apparatus according to Claim 3, wherein

15        specification of the message/action reaction relation update controlling portion is specification of an existing message/action relation between a first message and a first action to be intervened and specification of a second action to be added, as well as specification of intervention information on additional organizing of a reaction relation of the second action with the first message; and

20        a relation between the first message and the second action is additionally organized with the message/action reaction relation organizing portion, and object collaboration based on the relation between the first message and the first action is made parallel to a new object collaboration based on the relation between the first message and the second action.

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5.        The object collaboration apparatus according to Claim 3, wherein

30        specification of the message/action reaction relation update controlling portion is specification of an existing message/action relation between a first message and a first action to be intervened, specification of an existing second action outputting a first message and a third action to be added, and specification of intervention information on additional organizing of a new collaboration relation of the specified third action with the first action;

a relation in which the third action outputs the first message is additionally organized with the message/action reaction relation organizing portion, providing a new object collaboration; and

object collaboration by the relation between the second action, the first message and the first action becomes parallel to the new object collaboration by the relation between the third action, the first message and the first action.

6. The object collaboration apparatus according to Claim 3, wherein

if there is plurality of independent object collaborations in which messages and actions collaborate, then specification of the message/action reaction relation update controlling portion is specification of an existing first object collaboration and an existing second object collaboration to be intervened, specification of intervention information of coupling the specified independent object collaborations;

a new message/action reaction relation is additionally organized with the message/action reaction relation organizing portion between a first message outputted when executing an action on an ending side of the specified first object collaboration and a new action outputting a second message to which an action of the beginning side of the specified second object collaboration reacts, coupling the independent object collaborations.

7. The object collaboration apparatus according to Claim 6, wherein by eliminating the additionally organized message/action reaction relation with the message/action reaction relation organizing portion, the coupled object collaborations are separated into independent object collaborations.

8. The object collaboration apparatus according to Claim 3, further comprising a message/action reaction relation separation portion for separating an existing message/action reaction relation in the message/action reaction relation storage portion specified by the message/action reaction relation update controlling portion.

9. The object collaboration apparatus according to Claim 8, wherein specification of the message/action reaction relation update controlling portion

is specification of an existing message/action reaction relation to be separated and specification of an object having a new message/action reaction relation to be inserted;

based on the specification, the message/action reaction relation separation portion separates the existing relation of message and action;

based on the specification, the message/action reaction relation organizing portion associates the existing message with the new action and associates the new message outputted as a part of the new action with the existing action; and

the object having the new message/action reaction relation is inserted between the existing message and the exiting action.

10. The object collaboration apparatus according to Claim 9, wherein new message/action reaction relations by objects inserted between the existing message and the existing action are cascaded, and object collaboration from the existing message through cascaded collaborations of actions and messages to the existing action is achieved.

11. The object collaboration apparatus according to Claim 8, wherein when the relation between an existing message and an existing action is cascaded, and there is a relation from one message through several collaborations of actions and messages to one action,

specification of the message/action reaction relation update controlling portion is specification of a relation between an existing first message and first action and a relation between an existing second message and second action to be intervened, and specification of information to associate the specified first message with the second action and remove any objects between the two; and

with the message/action reaction relation organizing portion, the action content is changed from outputting the first message to outputting the second message, the object collaboration destination is changed such that the second action reacts to the second message, and existing objects pertaining to collaboration from the first action to the second message are removed.

12. The object collaboration apparatus according to Claim 8, wherein

when the relation between an existing message and an existing action is cascaded, and there is a relation from one message through several collaborations of actions and messages to one action, then

specification of the message/action reaction relation update controlling portion  
5 is specification of a relation between an existing first message and first action and a relation between an existing second message and second action to be intervened, and specification of information to associate the specified first message with the second action and remove any objects between the two;

the relation between the second message and the second action is separated by  
10 the message/action reaction relation separation portion; and

with the message/action reaction relation organizing portion, the first message is associated with the second action to change the object collaboration destination such that the second action reacts to the second message, and existing objects pertaining to collaboration from the first action to the second message are removed.

15 13. The object collaboration apparatus according to Claim 3, wherein object collaborations based on message/action reactions comprise:

an object collaboration core portion, in which object collaboration relations are maintained as a core; and

20 an object collaboration interface portion for interfacing collaboration between the object collaboration core portion and other objects; wherein

when an object collaboration relation is changed, the relations of the object collaboration core portion are maintained unchanged, and the object collaboration relation is changed by changing the collaboration destination of the object collaboration  
25 interface portion.

14. The object collaboration apparatus according to Claim 8, wherein object collaborations based on message/action reactions comprise:

an object collaboration core portion, in which object collaboration relations are  
30 maintained as a core; and

an object collaboration interface portion for interfacing collaboration between the object collaboration core portion and other objects; wherein

when an object collaboration relation is changed, the relations of the object collaboration core portion are maintained unchanged, and the object collaboration relation is changed by changing the collaboration destination of the object collaboration interface portion.

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15. The object collaboration apparatus according to Claim 14, wherein the object collaborations comprise a first object collaboration core portion, a first object collaboration interface portion that is an object collaboration interface portion for the first object collaboration core portion, a second object collaboration core portion and a second object collaboration interface portion that is an object collaboration interface portion for the second object collaboration core portion; wherein

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when the first object collaboration interface portion and the second object collaboration interface portion are associated by one message/action reaction relation and object collaboration has been organized,

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specification of the message/action reaction relation update controlling portion is specification of a separation of the collaboration between the first object collaboration interface portion and the second object collaboration interface portion, and specification of a new object to be inserted;

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the message/action reaction relation separation portion separates the collaboration between the first object collaboration interface portion and the second object collaboration interface portion based on the specification; and

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the message/action reaction relation organizing portion associates a relation of the first object collaboration interface portion with the object to be inserted and associates the object to be inserted with the second object collaboration interface portion based on the specification, inserting the new object.

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16. The object collaboration apparatus according to Claim 13, further comprising a function for notifying input pattern and output pattern of the object collaboration interface portion to the outside.

17. The object collaboration apparatus according to Claim 13, wherein an input pattern and an output pattern of the object collaboration interface portion can be

changed.

18. An object collaboration apparatus, wherein objects comprise:

a message receiving portion for monitoring and inputting messages that have  
5 been sent over a network;

a message/action reaction relation storage portion for storing relations between  
messages and information on actions that are reactions to the messages;

an action execution portion that executes actions in accordance with the  
message/action reaction relations;

10 a message/action reaction condition setting portion; wherein

a message/action reaction condition for executing an action corresponding to a  
received message is set for each object;

the message/action reaction relation storage portion stores message/action  
reaction conditions associated with message/action reaction relations; and

15 the action execution portion executes an action in response to a received  
message if the message/action reaction condition is fulfilled.

19. An object collaboration apparatus, wherein objects comprise:

a message receiving portion for monitoring and inputting messages that have  
20 been sent over a network;

a message/action reaction relation storage portion for storing relations between  
messages and information on actions that are reactions to the messages;

an action execution portion that executes actions in accordance with the  
message/action reaction relations; and

25 an object collaboration relation presentation portion for presenting objects and  
object collaboration relations that have been organized between objects;

wherein, taking an acceptance scope in which messages inputted by the  
message receiving portion are acceptable as input message pattern information and  
taking an output scope to which the action execution portion can output messages as  
30 output message pattern information, the object collaboration relation presentation  
portion presents the object collaboration relations to be presented as collaboration  
relations between the input message pattern information and the output message pattern

information.

20. The object collaboration apparatus according to Claim 19, wherein message/action reaction conditions for executing actions in response to received  
5 messages are set for each object, and the object collaboration relation presentation portion also includes the presentation of the message/action reaction conditions in the object collaboration relations to be displayed.

21. The object collaboration apparatus according to Claim 19 or 20, wherein the  
10 object collaboration relation presentation portion displays the objects as icons, displays the object collaboration relations as link information between the icons, and visualizes objects and organized object collaboration relations graphically.

22. The object collaboration apparatus according to Claim 19 or 20, wherein the  
15 object collaboration relation presentation portion presents the object collaboration relations as a table.

23. The object collaboration apparatus according to Claim 19 or 20, wherein the  
20 object collaboration relation presentation portion expresses the input message pattern information and the output message pattern information as tags, and displays the object collaboration relations with a programming language including these tags.

24. The object collaboration apparatus according to Claim 19 or 20, wherein the  
25 object collaboration relation presentation portion includes an object collaboration information inquiry function for inquiring object collaboration information of each of the objects; an object collaboration information collecting function for collecting object collaboration information of the objects, which is given by the objects in response to an inquiry to the objects; an object collaboration relation organizing function for organizing information of the object collaboration relations of all objects from the  
30 collected object collaboration information of the objects; and an object collaboration relation presentation function for presenting the organized object collaboration relations.



25. The object collaboration apparatus according to Claim 24, wherein the objects further comprise an object collaboration information notification function for responding with the object's object collaboration information to an inquiry by the object collaboration information inquiry function.

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26. The object collaboration apparatus according to Claim 24, comprising an object collaboration control portion, the object collaboration control portion comprising an object collaboration change detection function for detecting when a change in the object collaboration relations organized by the object collaboration relation organizing function occurs; an object collaboration illogicality detection function for detecting when a collaboration illogicality occurs in the object collaborations; and an object collaboration logic protection function for canceling the object collaboration change when the object collaboration illogicality detection portion has detected an illogicality in the object collaborations.

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27. An object collaboration apparatus, wherein objects comprise:  
a message receiving portion for monitoring and inputting messages that have been sent over a network;

a message/action reaction relation storage portion for storing relations between messages and information on actions that are reactions to the messages;

an action execution portion that executes actions in accordance with the message/action reaction relations; and

an object searching portion which, taking a message pattern exchanged between objects that are present on the network as a search key, searches for objects that have this message pattern as an input/output message pattern; wherein

to form an object collaboration from a first object serving as a starting point to a second object serving as an ending point, the object searching portion detects an output message pattern of the first object and an input message pattern of the second object, searches objects collaborating with these message patterns, taking the detected message patterns of the objects as a search key, and forms an object collaboration from the first object serving as the starting point to the second object serving as the ending point.

28. The object collaboration apparatus according to Claim 27, wherein the object searching portion includes an object message pattern detection portion, and specified input message patterns and output message patterns can be detected with the object message pattern detection portion.

29. The object collaboration apparatus according to Claim 27, wherein the object searching portion

in a first search, takes the output message pattern of the first object as the input message pattern and any pattern as the output message pattern, and searches a third object group;

in a second search, takes the output message patterns of the objects of the third object group as the input message pattern and any pattern as the output message pattern, and searches a fourth object group;

selects from the output message patterns of the objects of the fourth object group a fourth object whose output message pattern matches with the input message pattern of the second object, and selects from the objects of the third object group a third object having as the output message pattern the input message pattern of the selected fourth object; and

forms an object collaboration from the first object via the third object and the fourth object to the second object.

30. The object collaboration apparatus according to Claim 29, wherein if among the objects of the fourth object group there is no object whose output message pattern matches with the input message pattern of the second object, then, in a third search, taking the output message patterns of the objects of the fourth object group as the input message pattern and any pattern as the output message pattern, the procedure of searching a fifth object group is repeated, repeating the search of object groups until one of the output message patterns of the objects in those object groups matches the input message pattern of the second object, and an object collaboration from the first object to the second object is formed.

31. The object collaboration apparatus according to Claim 27, wherein the object searching portion

in a first search, takes any pattern as the input message pattern and the input message pattern of the second object as the output message pattern, and searches a third object group;

in a second search, takes any pattern as the input message pattern and the input message patterns of the objects of the third object group as the output message pattern, and searches a fourth object group;

selects from the input message patterns of the objects of the fourth object group a fourth object whose input message pattern matches with the output message pattern of the first object, and selects from the third object group a third object having as the input message pattern the output message pattern of the selected fourth object; and

forms an object collaboration from the first object via the fourth object and the third object to the second object.

32. The object collaboration apparatus according to Claim 31, wherein if among the objects of the fourth object group there is no object whose input message pattern matches with the output message pattern of the first object, then, in a third search, taking any pattern as the input message pattern and the input message patterns of the objects of the fourth object group as the output message pattern, the procedure of searching a fifth object group is repeated, repeating the search of object groups until one of the input message patterns of the objects in those object groups matches the output message pattern of the first object, and an object collaboration from the first object to the second object is formed.

33. The object collaboration apparatus according to Claim 27, wherein the object searching portion

in a first search, takes the output message pattern of the first object as the input message pattern and any pattern as the output message pattern, and searches a third object group;

in a second search, takes any pattern as the input message pattern and the input message pattern of the second object as the output message pattern, and searches a

fourth object group;

selects a combination, in which the output message patterns of the objects of the third object group matches with the input message pattern of the fourth object group, and takes the object of the third object group in this combination as the third object the  
5 object of the fourth object group in this combination as the fourth object; and

forms an object collaboration from the first object via the third object and the fourth object to the second object.

34. The object collaboration apparatus according to Claim 33, wherein if among  
10 the objects of the third object group there is no object whose output message pattern matches with the input message pattern of an object of the fourth object group, then, in a third search, taking the output message patterns of the objects of the third object group as the input message pattern and any pattern as the output message pattern, the procedure of searching a fifth object group is repeated, in a fourth search, taking any  
15 pattern as the input message pattern and the input message patterns of the objects of the fourth object group as the output message pattern, the procedure of searching a sixth object group is repeated, repeating the search of object groups until one of the output message patterns of the objects in one of the object groups matches the input message pattern of the other object group, and an object collaboration from the first object to the  
20 second object is formed.

35. A computer-readable storage medium storing a program for realizing an object collaboration apparatus driven in accordance with message/action reactions, wherein objects comprise:

25 a message receiving step for monitoring and inputting messages that have been sent over a network;

a message/action reaction relation storage step for storing message/action reaction relations storing relations between messages and information on actions that are reactions to the messages;

30 an action execution step for executing actions in accordance with the message/action reaction relations;

a message/action reaction relation update step for controlling an updating of

a message/action reaction relation separation step for separating an existing message/action correspondence relation stored in the message/action reaction relation

5 storage step specified in the message/action reaction relation update step; and

a message/action reaction relation organizing step for associating specified actions to specified messages in the message/action reaction relation update step; and

wherein a new relation between an action and a message is organized by intervening into an existing relation between an action and a message.

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36. A computer-readable storage medium storing a program for realizing an object collaboration apparatus driven in accordance with message/action reactions, wherein objects comprise:

a message receiving step for monitoring and inputting messages that have been

15 sent over a network;

a message/action reaction relation storage step for storing message/action reaction relations storing relations between messages and information on actions that are reactions to the messages;

an action execution step for executing actions in accordance with the

20 message/action reaction relations:

a step of setting for each object a message/action reaction condition for  
 ing an action corresponding to a received message; and

a step of storing the message/action reaction conditions associated with the message/action reaction relations;

25 wherein the action execution step executes an action in response to a received message if the message/action reaction condition is fulfilled; and

a new reaction between a message and an action is organized if, intervening into an existing relation between a message and an action, the message/action reaction condition is fulfilled.

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37. A computer-readable storage medium storing a program for realizing an object collaboration apparatus driven in accordance with message/action reactions, wherein

object comprise:

a message receiving step in which objects monitor and input messages that have been sent over a network;

5 a message/action reaction relation storage step for storing message/action reaction relations storing relations between messages and information on actions that are reactions to the messages;

an action execution step for executing actions in accordance with the message/action reaction relations;

10 an object collaboration relation presentation step for presenting objects and object collaboration relations that have been organized between objects;

wherein, taking messages inputted in the message receiving step as input message pattern information and, if a message is output in the action execution step, taking this message as output message pattern information, the object collaboration relation presentation step presents the object collaboration relations to be presented as  
15 collaboration relations between the input message pattern information and the output message pattern information.